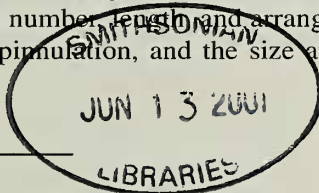


## New species of antipatharians (Cnidaria: Anthozoa) from Madeira, with the establishment of a new genus

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*Abstract.*—A new genus, *Tanacetipathes*, and two new species of antipatharian corals, *T. cavernicola* and *T. wirtzi*, are described from the waters off Madeira. Included in the new genus are the species *T. tanacetum* (Pourtalès, 1880), *T. hirta* (Gray, 1857), *T. barbadensis* (Brook, 1889), *T. thamnea* (Warner, 1981), and *T. spinescens* (Gray, 1857). Species in the genus are differentiated by the branching pattern of the corallum; the number, length, and arrangement of the primary pinnules, the degree of subpinnulation, and the size and density of the spines.



Several years ago a large collection of antipatharian corals was sent to the Smithsonian Institution by Dr. Peter Wirtz of the University of Madeira. Included in this collection were representatives of two undescribed species hand-collected from a submarine cave off Madeira at a depth of 9–15 m. It was determined that these species are closely related to several other Eastern and Western Atlantic species, and that together they merit recognition at the genus level.

The type specimens of the new species have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM).

### Family Antipathidae

#### *Tanacetipathes*, new genus

*Type species.*—*Antipathes tanacetum* Portalès, 1880. Type locality: Western Atlantic, Lesser Antilles; see Opresko (1972), for a complete description of the species.

*Diagnosis.*—Corallum monopodial or branched. Stem and branches complexly pinnulate, producing a bottlebrush appearance. Primary pinnules arranged in four to six rows along the axis and also in alternating biserial groups of varying regularity. Posterior-most primary pinnules with 1–3

orders of subpinnules; secondary and higher order pinnules present on abpolypar, and sometimes polypar side of lower order pinnules. Anterolateral and anterior primary pinnules (when present) simple or with secondary and sometimes higher order subpinnules.

*Remarks.*—The genus is characterized by the presence of four, sometimes five, and occasionally six rows of primary pinnules and at least one order of subpinnules (secondary pinnules). Subpinnules always occur (with varying frequency) on the abpolypar side and near the base of the posterior-most primary pinnules, and in some species they may also be present on the polyp side. Species in the genus are differentiated by the branching of the corallum; the number, length, and arrangement of the primary pinnules; the degree of subpinnulation; and the size and density of the spines. The genus includes the type species, *Tanacetipathes tanacetum* (Portalès), as well as *T. hirta* (Gray, 1857), *T. barbadensis* (Brook, 1889), *T. thamnea* (Warner, 1981), *T. spinescens* (Gray, 1857), and the two new species described below.

*Etymology.*—The genus name, is derived from “*tanacetum*” (Latin; composite, tansy), the species name of the type species.



Fig. 1. *Tanacetipathes cavernicola*, n. sp., holotype, USNM 96956; height 17 cm.

*Geographic distribution.*—The genus is known from the northeastern and northwestern Atlantic. Specimens of species that may be assigned to *Tanacetipathes* have also been collected from Ascension Island and the northeast coastline of South America (undescribed material in the USNM).

*Tanacetipathes cavernicola*, new species  
Figs. 1–4

*Material examined.*—Madeira, Canico de Baixo, 9 m, on vertical wall of cave (type locality); P. Wirtz, August, 1995 (holotype,

USNM 96956). Madeira, Canico de Baixo, 10 m, in cave, 27 Apr 1995, P. Wirtz, (paratypes, USNM 96959, several branches).

*Diagnosis.*—Corallum branched to 5th order or more; stem and branches pinnulate in bottlebrush pattern with up to three orders of pinnules. Primary pinnules arranged in 4 (sometimes 5 and very rarely 6) rows, of varying regularity, and in alternating biserial groups, consisting of one lateral (or posterolateral), one anterolateral (or lateral), and one anterior pinnule (not always present). Usually one, sometimes two and rare-

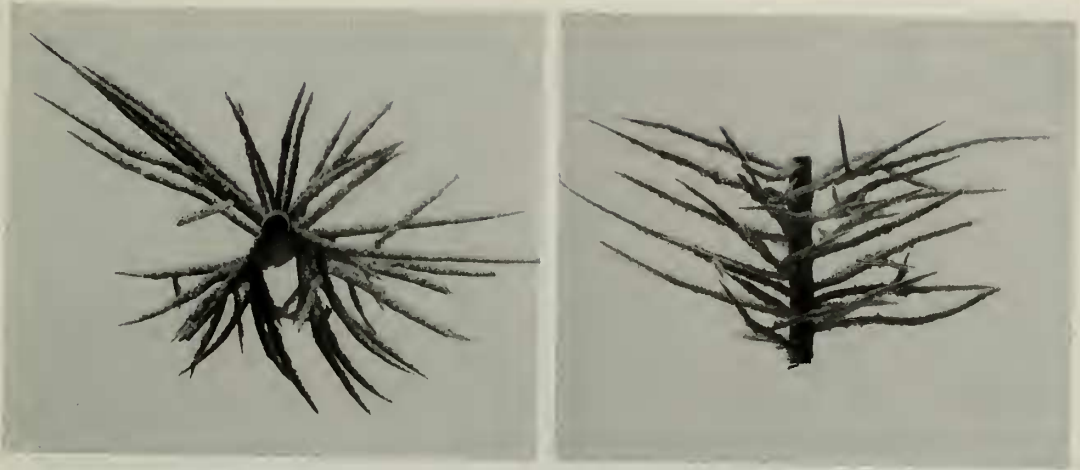


Fig. 2. *Tanacetipathes cavernicola*, n. sp., holotype, USNM 96956. A. Cross sectional view of branch with pinnules;  $\times 2.5$ . B. Lateral view of branch with pinnules,  $\times 2.5$ .

ly three uniserial secondary pinnules on some posterior-most primaries. Secondary pinnules occasionally present on anterolateral primaries. Secondary pinnules usually confined to abpolypar side of primaries and inclined distally relative to the primary. Tertiary pinnules very rarely present on secondary pinnules on posterior-most primaries. Primary pinnules usually less than 1.5 cm long, inclined and/or curved distally (distal angle  $70^{\circ}$ – $80^{\circ}$ ); secondary pinnules usually not more than 1 cm long, extending out laterally in the plane delineated by the primaries in each bilateral group; tertiary pinnules usually less than 0.5 cm in length. Spines on pinnules simple, elongate, conical, acute, very finely papillose, and inclined distally; polypar spines mostly 0.2–0.25 mm (from midpoint of base to apex), but up to 0.3 mm tall; abpolypar spines smaller, narrower, and more distally inclined than polypar spines. Spines arranged in rows extending along length of axis; 4–6 rows visible from one aspect; 4.5 to 5.5 spines per millimeter in each row. Polyps 0.65–0.70 mm in transverse diameter, arranged uniserially on lateral, or upper or lower side of the pinnules; 9–12 polyps per centimeter.

*Description of holotype.*—The holotype (USNM 96956) is 17 cm high, 16 cm wide,

and about 4 cm thick (Fig. 1). The stem just above the basal plate is about 3.5 mm in diameter. The corallum is branched with up to 5 orders of sub-branches. A cluster of six primary branches arises from the lowermost 2.5 cm of stem. Several of the major branches extend from the lower part of the stem to the top of the corallum; the largest is about 18 cm long and about 1 mm in diameter near its midpoint. The larger branches form two overlapping planes; the smaller ones tend to be placed laterally, at varying distances, usually 1–2 cm or more apart. The branches are straight or curved; the distal branch angles range from  $45^{\circ}$  to  $90^{\circ}$ . Over most of the corallum the primary pinnules occur in 4 rows of varying regularity and in alternating bilateral groups of two each (Fig. 2); occasionally a fifth primary occurs on the anterior side of the axis, and very rarely a sixth is also present on the anterior side, resulting in bilateral groups of 3 pinnules each. Within each row the pinnules are spaced about 2 mm apart resulting in 5–6 per centimeter. In each lateral group, the posterolateral pinnules are placed on the same level or slightly below (proximal to) the adjacent lateral pinnule. The primary pinnules are not uniform in size; the largest, which occur on the mid to lower portions of the branches, are mostly

1 to 1.5 cm long (rarely up to about 2.0 cm). The anterolaterals are usually slightly shorter than the posterolaterals. The maximum basal diameter of primary pinnules is 0.45–0.50 mm (including spines). The secondary pinnules, which occur on the abpolypar side and near the base of the primary pinnules, are generally 5–10 mm in length and are about as thick as the primary pinnules. There is usually only one secondary per primary, but occasionally there are two, and rarely three. A single secondary pinnule sometimes occurs on an anterolateral primary pinnule, usually on the lateral (abpolypar) side. Tertiary subpinnules are usually absent; when present they occur on the lowermost secondary pinnules, are less than 5 mm in length, and slightly smaller in diameter than the secondaries and primaries. The tertiary pinnules can be in the same plane as the secondaries or they can be directed distally or basally relative to the direction of the branch.

The axial spines (Figs. 3, 4) are relatively large, conical, acute, slightly compressed laterally, and faintly papillose. They are unequal in size around the circumference of the axis; those on the polyp side of the axis are larger than those on the abpolypar side. The polypar spines near the tips of the pinnules (axial diameter about 0.07 mm) are about 0.15 mm tall (as measured from the midpoint of base to apex); on the middle to lower portions of the pinnules (axial diameter 0.20–0.30) the polypar spines are mostly 0.20–0.25 mm but reach 0.30 mm in places. The abpolypar spines are 0.12–0.20 mm. The pinnular spines are arranged in rows along length of the axis; 4–6 rows are visible in lateral view excluding rows in which the spines are only partially visible). The distance between adjacent spines in each row ranges from 0.23 to 0.36 mm, resulting in 4.5–5.5 spines per millimeter in each row. The spines on stem and larger branches are more acicular than those on pinnules. On the basal plate they are very narrow, up to 0.4 mm tall, and some are forked at their apex.

The polyps are very slightly elongated along the transverse axis; they are 0.65–0.70 mm in transverse diameter (from the distal edge of distal lateral tentacles to the proximal edge of proximal lateral tentacles). The polyps are arranged in a single row, usually on the lateral side of the pinnules, but occasionally the row is offset towards the upper or lower side of the pinnules. The inter-polyp space is about 0.3 mm, and there are 9–12 polyps per centimeter.

*Field notes.*—Colonies of *T. cavernicola* are reported to be light gray in color when viewed in situ and the branches are rather flexible and difficult to break (P. Wirtz, pers. comm.).

*Comparisons.*—*Tanacetipathes cavernicola*, n. sp. resembles *T. tanacetum* (Pourtalès) in the pattern of subpinnulation; however, the latter species has more secondary and tertiary pinnules. Furthermore, colonies of *T. tanacetum* are usually monopodial or only branched to the first order; whereas colonies of *T. cavernicola* are branched more extensively. *Tanacetipathes cavernicola* is also similar to *A. spinescens* (Gray, 1857). The latter species forms large, densely branched colonies, with the pinnules more crowded, distally directed, and arranged in close spirals (Brook, 1889). As described and illustrated by Brook (1889), the subpinnulation in *T. spinescens* is more extensive, and is more pronounced on the side of the primary pinnules in the direction of the spiral. The primary pinnules are up to 1.5 cm long and the polypar spines, as estimated from the illustration given by Brook (1889), are about 0.19 mm.

*Etymology.*—The species name, *cavernicola* is derived from “*caverna*” (Latin, cave) and “*cola*” (Latin, inhabitant), in reference to the preferred habitat.

*Distribution.*—The species is only known from Madeira; 9–10 m.

*Tanacetipathes wirtzi*, new species  
Figs. 5–8

*Material examined.*—Madeira, Canico de Baixo, 9 m, in cave, P. Wirtz, August, 1995

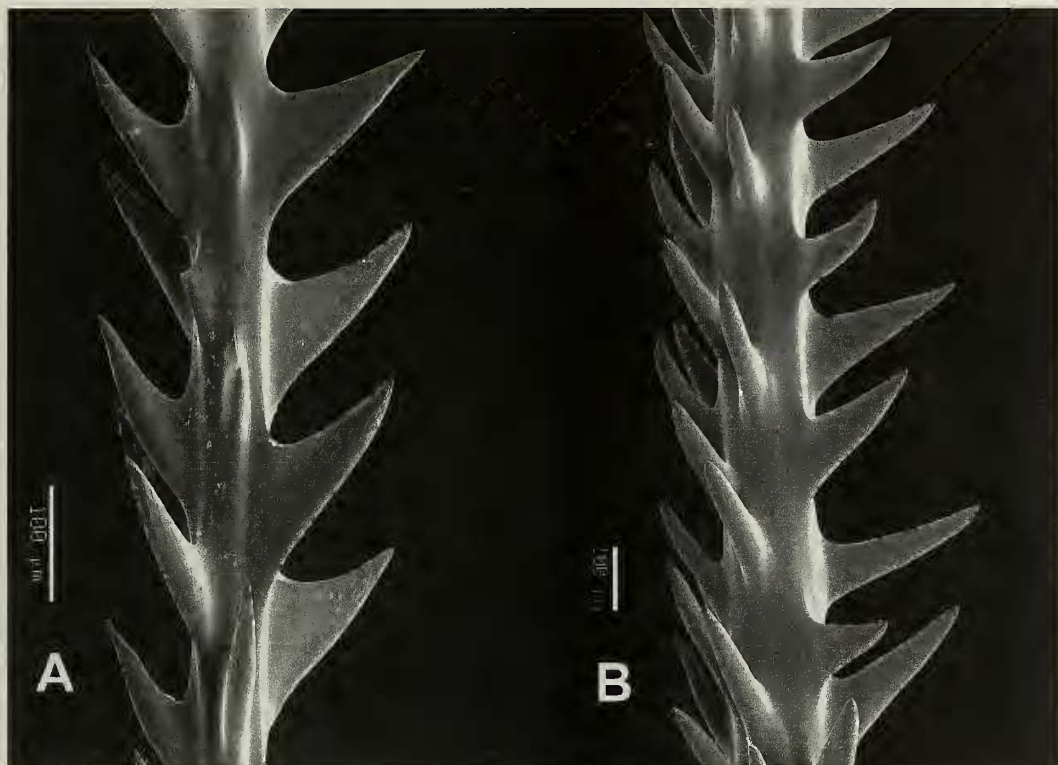


Fig. 3. *Tanacetipathes cavernicola*, n. sp., holotype, USNM 96956. A. Spines on distal section of pinnule. B. Spines on midsection of pinnule.

(holotype, USNM 96955). Madeira, Canico de Baixo, 15 m, in cave (type locality), P. Wirtz, April, 1994 (paratype, USNM 96954); Madeira, Canico de Baixo, 10 m, in cave, P. Wirtz, August, 1995 (paratype, USNM 96960).

**Diagnosis.**—Corallum branched sparsely, some branches arising from near base of stem, and extending to top of corallum. Stem and branches pinnulate in bottlebrush fashion. Primary pinnules up to 2.5 cm long; arranged in 4–6 axial rows and in alternating bilateral groups consisting of one posterolateral, one anterolateral, and one anterior pinnule (when present). Posterolateral pinnules usually simple or occasionally with one (rarely two) secondary pinnules on abpolypar side of axis, and usually occurring near base, but sometimes on distal portion of primary. Secondary pinnules 0.5–1.0 cm in length, inclined distally rel-

ative to the primary pinnule. Tertiary pinnules absent. Anterolateral and anterior pinnules almost always simple, without secondary pinnules. Largest primary pinnules 1.5–2.5 cm in length, 0.7–0.8 mm in diameter at base (including spines), and inclined distally (distal angle  $70^{\circ}$ – $80^{\circ}$ ) relative to the branch or stem. Spines on pinnules conical, acute, slightly compressed, faintly papillose, and inclined distally. Polypar spines on lower portion of pinnules 0.24–0.30 mm from center of base to apex; abpolypar spines up to 0.2 mm, narrow and inclined distally. Spines arranged in 5–8 axial rows (as viewed from one aspect), with 4–6 spines per millimeter in each row. Polyps mostly 0.7–0.8 mm in transverse diameter; interpolypar space 0.2–0.3 mm; 8–10 polyps per centimeter.

**Description of holotype.**—The holotype (USNM 96955) is about 7 cm high and

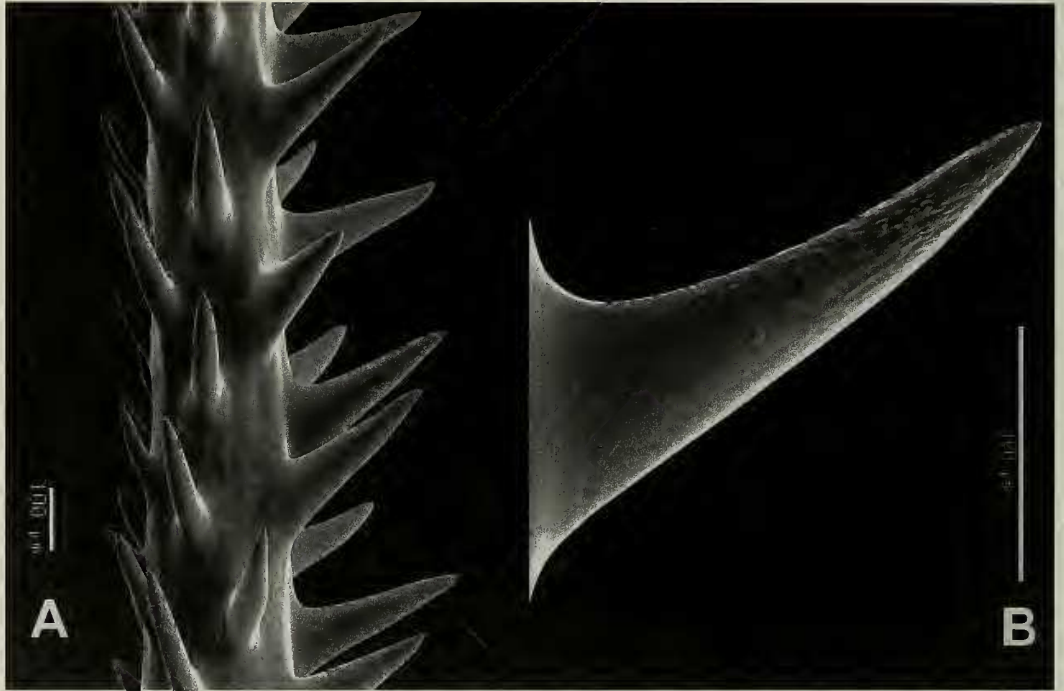


Fig. 4. *Tanacetipathes cavernicola*, n. sp., holotype, USNM 96956. A. Spines on basal section of pinnule. B. Single polypar spine.

about as wide (Fig. 5); it has a stem diameter of 1.2 mm just above the basal plate. The corallum is branched to the second order, with three branches arising directly from the stem; one of these bears a secondary branch. The lowest branch occurs 2 mm above the basal plate, and all three main branches arise within the first 1 cm. Several of these branches are nearly as long as the stem and extend to the top of the corallum (Fig. 5).

The primary pinnules are straight and stiff and arranged in 4 to 6 axial rows and in alternating bilateral groups. Within each row the pinnules are spaced 2–2.5 mm apart, resulting in 5–6 per centimeter. The distal angle formed between the pinnules and the branch or stem from which they originate is 70–80°. The smaller pinnules tend to be straight, the larger ones are curved upward toward the distal end of the branch. In each lateral group, the primary pinnules are placed at nearly the same level or slightly offset from one another; how-

ever, they are not arranged in a regular semi-spiral pattern. The maximum length of the primary pinnules is 2.2 cm, and the diameter near the base is about 0.40 mm without spines and about 0.75 mm with spines. The longest primary pinnules are usually those in the posterolateral rows, the shortest are those in the anterior rows (when these are present).

Most of the primary pinnules are simple. A single, simple, secondary pinnule is present on a small number of posterolateral primary pinnules. The secondary pinnules are generally less than 1 cm long; most arise at a point less than 1 mm from the base of the primary. Rarely, two secondaries occur on the same primary. Secondary pinnules are not normally found on the anterior or anterolateral primary pinnules. Tertiary pinnules are absent.

The axial spines (Figs. 6, 7) are large, conical, acute, and slightly papillose. The polypar spines near the tip of a pinnule (axial diameter 0.05 mm) are about 0.1 mm tall



Fig. 5. *Tanacetipathes wirtzi*, n. sp., holotype, USNM 96955; height 7 cm.

(from middle of base to apex). Where the axial diameter is 0.1 mm, the polypar spines measure about 0.2 mm, and where the axis is 0.3–0.4 mm (near the base of the pinnule), the polypar spines are up to 0.3 mm. The abpolypar spines are generally smaller than the polypar spines by 0.02–0.04 mm; they are also narrower and can be strongly inclined distally. The spines are arranged in 5–8 rows as seen in one lateral view of a pinnule. The distance between adjacent spines in each row is usually 0.2–0.3 mm. The spines on the branches are more acicular than those on the pinnules, and those on the lower part of the stem and on the basal plate are very narrow and up to 0.30 mm tall; several on the basal holdfast are forked at the tip.

The polyps are slightly elongated along the transverse axis; the distance from distal edge of the distal lateral tentacles to proximal edge of the proximal lateral tentacles is 0.7–0.8 mm; the interpolypar space is about 0.3 mm, resulting in 8–10 polyps per centimeter. The polyps are arranged uniserially on the pinnules and occur primarily on the lateral sides relative to the direction of the branch on which the pinnules occur.

*Remarks.*—One paratype (USNM 96954) is a single branch 14 cm long (Fig. 8A), and the second (USNM 96960) is a small colony about the same size as the holotype. Both paratypes show the same general pinulation pattern as the holotype, with most of the primary pinnules being simple, a few posterolaterals with a single secondary pin-

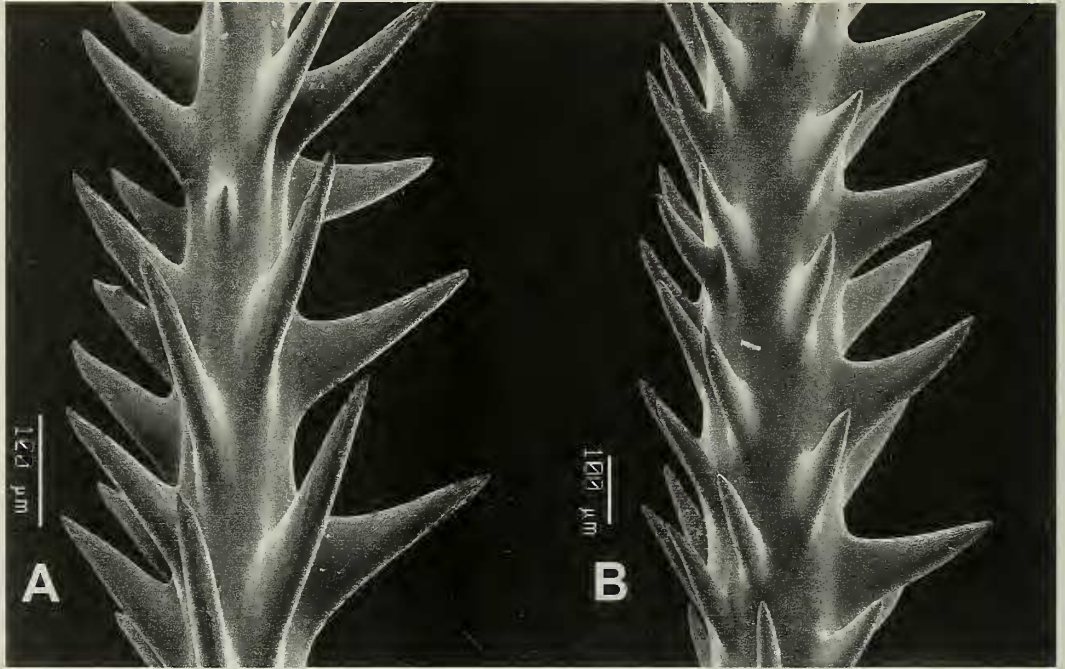


Fig. 6. *Tanacetipathes wirtzi*, n. sp., holotype, USNM 96955. A. Spines on distal segment of pinnule. B. Spines on mid section of pinnule.

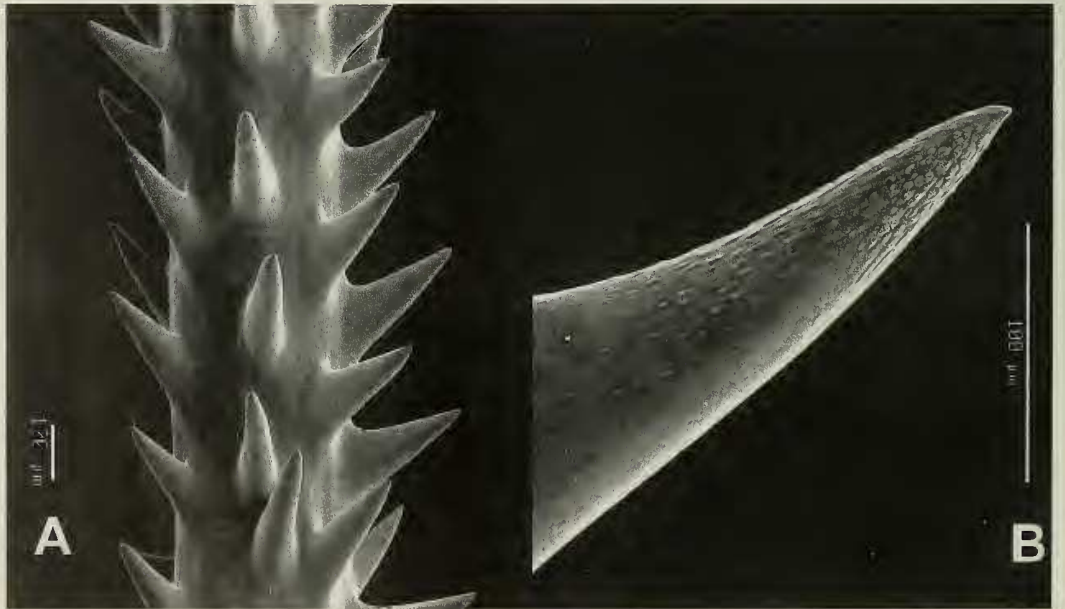


Fig. 7. *Tanacetipathes wirtzi*, n. sp., holotype, USNM 96955. A. Spines on basal section of pinnule. B. Single polypar spine.



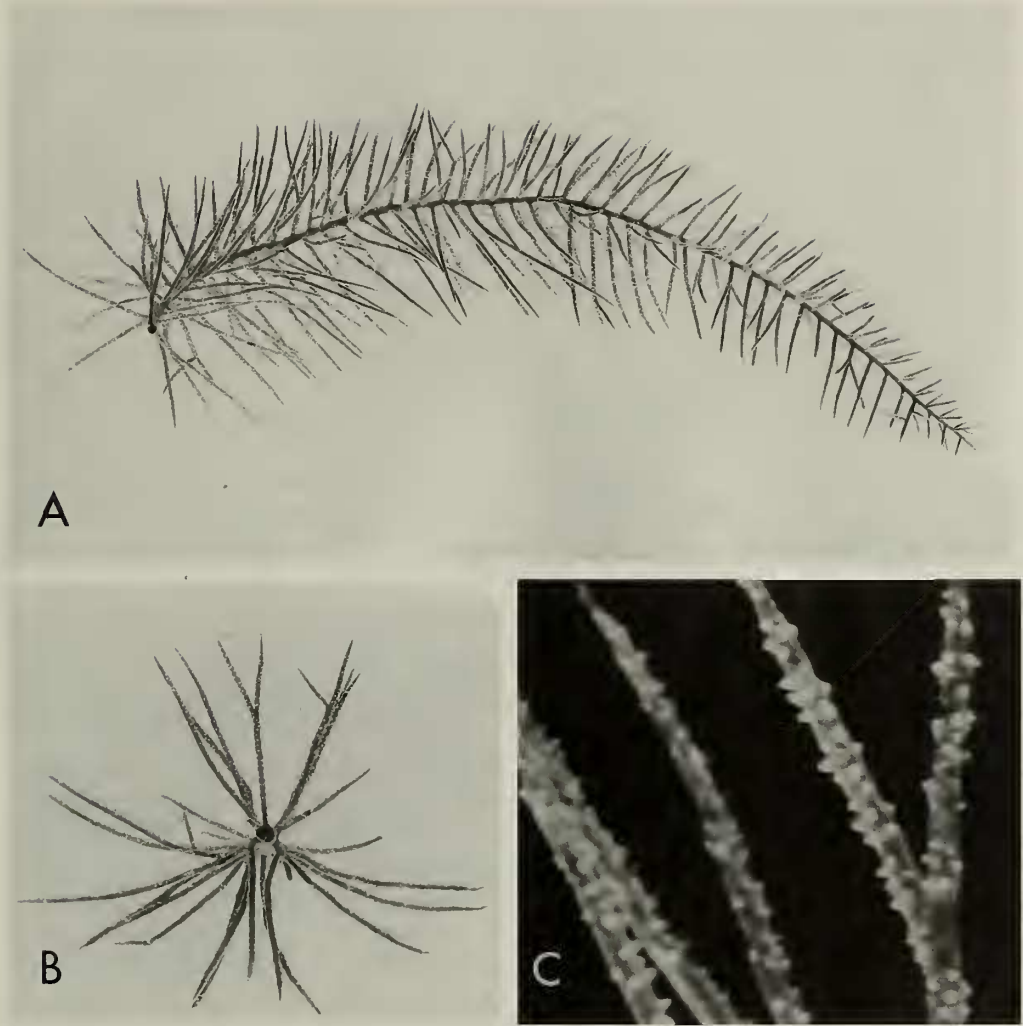


Fig. 8. *Tanacetipathes wirtzi*, n. sp., paratype, USNM 96954. A. Entire corallum. B. Cross section of branch. C. Polyps on pinnules;  $\times 4.7$ .

nule near the base, and with a secondary pinnule sometimes occurring on the distal portion of a primary pinnule (Fig. 8B). The primary pinnules on both paratypes reach a maximum length of about 2.5 cm. In one paratype (USNM 69660), the spines on the stem reach a larger maximum size (about 0.4 mm) and many are multi-forked at their tip. The polyps (Fig. 8C) are 0.7–0.8 mm in transverse diameter; the interpolyp space varies from 0.2 to 0.3 mm, and there are 9–10 polyps per centimeter.

*Field notes.*—Colonies of *T. wirtzi* are

reported to be dark brown in color when viewed in situ and rather brittle and easy to break (P. Wirtz, pers. comm.).

*Comparisons.*—*Tanacetipathes wirtzi* is closely related to *T. cavernicola*, n. sp., and the two species are difficult to differentiate on the basis of the size or morphology of the spines or polyps. The major differences between the two species lie in the maximum length of the primary pinnules (2–2.5 cm in *T. wirtzi* and 1.5–2.0 cm in *T. cavernicola*), and in the degree of subpinnulation. In *T. wirtzi* most of the primary pin-

nules are simple, and the secondary pinnules, when present, are simple and usually occur near the base of the posterolateral primaries, although here and there a secondary pinnule may also occur on the distal segment of a lateral or anterolateral primary. In *T. cavernicola* secondary pinnules commonly occur on the posterolateral primaries, and in places, especially in the older portions of the corallum, tertiary pinnules may also be present.

*Tanacetopathes wirtzi* resembles *T. barbadensis* (Brook, 1889) in having only a few secondary pinnules on the posterolaterals; however, the pinnules in *T. wirtzi* are shorter than those in *T. barbadensis* (2.5 cm vs. 4 cm or more). Furthermore, colonies of *T. barbadensis* are monopodial or only sparsely branched, and the branches, when present, are relatively long and occur primarily on the upper portion of the corallum. In *T. wirtzi* the branching takes place on the lower part of the corallum, just above the basal plate.

*Etymology.*—The species is named after Peter Wirtz of the University of Madeira who collected the specimens and made them available for study.

*Distribution.*—The species is only known from Madeira; 9–10 m.

#### Acknowledgments

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